

Amendments to the Drawings:

The attached drawing sheet replaces the single drawing sheet in the application. The drawing sheet has been amended to show that the drawing is prior art.

Attachment: Replacement Sheet
Annotated Sheet Showing Changes

REMARKS

Claim Objections and Section 112 Rejection

Applicant has corrected the spelling of "shaft" in Claim 1 and has corrected the abbreviation "MB₂-Z" in Claim 2.

Claim Rejections – 35 USC 103

Examiner rejected all claims as being unpatentable over Mustonen in view of Donaldson or unpatentable over Mustonen and Donaldson in view of various other references. Applicants request reconsideration.

Applicants have amended the independent claims to make clear that all claims are limited to underwater cutting and underwater welding. All of Examiners rejections are based on the combination of the teachings of Mustonen and Donaldson. Applicants submit that there is no suggestion in the prior art to combine these two references.

Mustonen

There is nothing in Mustonen to suggest an electrode of the type described in Donaldson. The only electrode material specifically referred to in Mustonen are "tungsten based materials" (col 2, line 9). Mustonen does state generally that the electrode could be a "consumable electrode or more preferably a non-consumable" (col 2, line 7). As explained in the Background Section of the present application, Applicants stated that aluminum, copper and tungsten electrodes were found to be unsatisfactory and that graphite had been found to be a satisfactory material and that it had been used successfully. Tungsten was found to be generally unsatisfactory "because low melting point inter-metallic compounds are formed with the metal being cut that erodes the electrode".

Donaldson

There is nothing in Donaldson that suggest that the electrode material described therein would be useful for underwater cutting and welding. Donaldson does state (col 2, lines 42-64) that the conductor is useful as an electrode for electric discharge machining. He further states that a dielectric fluid usually floods the gap between the electrode and the work piece to help control the current and supply cooling. The Mustonen device is used for cutting and welding underwater, mostly in the ocean. Ocean water is not a dielectric (certainly not the type of dielectric typically used in EDM machining) and there is nothing in the Mustonen disclosure to indicate that the water driving the hydraulic motor would qualify as a dielectric as contemplated in the Donaldson disclosure.

Mustonen plus Donaldson

As described above, there is nothing in either Mustonen or Donaldson that suggest the combination of the technologies described in those patents. Examiner has not suggested any other prior art that suggest the combination and Applicants are not aware of any. Furthermore, even if they were combined as pointed out in the present application the result (as demonstrated by Applicants' experiments) would not avoid significant erosion or produce an electrode that is better than the much less expensive graphite electrodes. Applicants stated on page 3 of the specification:

"However, some significant erosion resulted from the flaking off of ceramic powders at the outer surface of the copper infiltrated electrodes when the surface copper melted during the cutting process. To minimize this problem, Applicants have modified the ceramics in the compositions described in the '547 patent. In a preferred embodiment, the metal content in the voids in the ceramic matrix is reduced from at least 70% to between 10% and 30%. In another preferred embodiment ceramic fibers are used in place of ceramic powders. In a third preferred embodiment ceramic wires such as ZrB_2 wires are utilized instead of the ZrB_2 powder. ZrB_2 wires are preferably prepared using a chemical process to convert the Zr wires to ZrB_2 wires. Bundles of the ZrB_2 wires may then be infiltrated with the copper."

Thus, in conclusion, there is nothing in the prior art that would suggest the combination of Mustonen and Donaldson and even if they were combined improvements not described in either patent would be required to provide a better combination than the prior art Mustonen and graphite electrodes. For the above reasons Applicants submit that Mustonen and Donaldson do not teach underwater welding and cutting with the claimed torch-electrode combination as presently claimed.

DRAWINGS

The Examiner in his summary sheet objected to the drawing but did not give his reason for doing so. Applicants suspect that Examiner felt the drawing should be identified as prior art since it is the same as the drawing in Mustonen. Applicants have therefore modified the drawing to indicate that it is a prior art drawing.

CONCLUSION

Thus, for all the reasons given above; this application as the claims are presently limited, define a novel, patentable, and truly valuable invention. Hence allowance of all of the outstanding claims of this application is respectfully submitted to be proper and is respectfully solicited.

Respectfully Submitted,



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~~REPLACEMENT SHEET~~
ANNOTATED SHEET
SHOWING CHANGES

PRIOR
ART

